

THIS MONTH'S LEADING FEATURE

Getting Started on Microwave ATV

The first of a two part article by Dave McQue, G4NJU

MY REAL INTEREST in Amateur TV was aroused after a demonstration at my local club by G4MDU some eight years ago. I did have an early encounter with television way back in 1948 when I built a TV set using a 6 inch VCR517 radar tube and various bits from other wartime surplus radar sets. I later made a loft slot-antenna out of chicken netting to receive the BBC from Alexandra Palace.

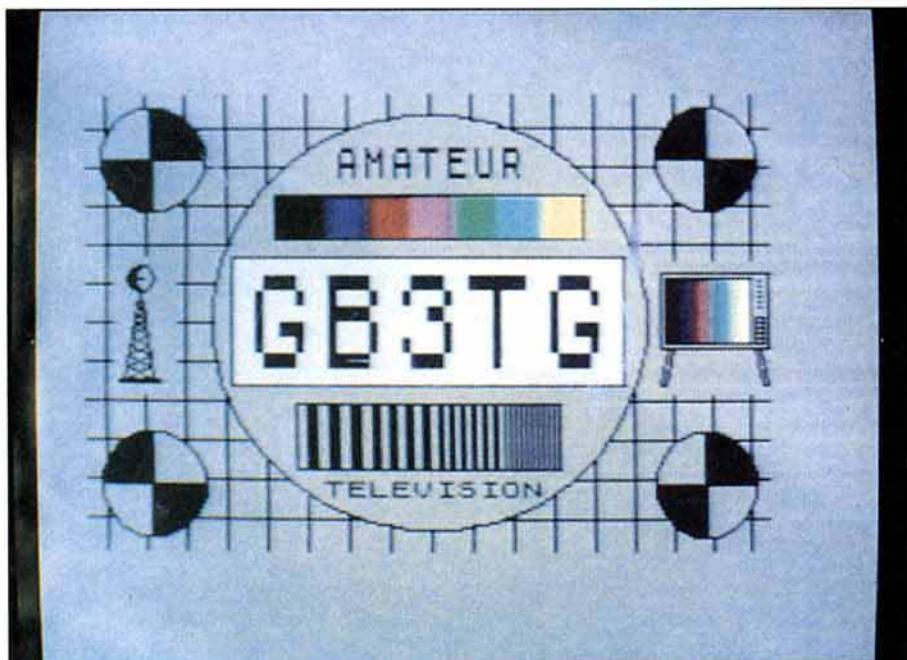
At the time of the club demonstration GB3TV, the Dunstable Downs ARC's ATV repeater, had been in action for a year or so. However, now there are many amateur TV repeaters on the 23 and 3cm bands – most of which radiate pictures continuously in 'Beacon mode' when not repeating.

There is still ATV activity on the 70cm band using AM double sideband but this is naturally restricted to simplex operation with monochrome pictures using the ATV talkback frequency, 144.75MHz, for sound.

THE 23CM BAND

ON 23CM GB3TV TRANSMITS on 1318MHz whilst receiving on 1249MHz. Other repeaters have to have displacements of one or two megahertz to avoid clashes with the CAA's local radar, which is the Primary user. As with satellites FM rather than AM is used. The 18MHz channel bandwidth permits the transmission of a standard PAL colour picture with intercarrier sound on a 6MHz subcarrier.

The deviation, however, is restricted to a maximum of 3.5MHz, somewhat less than



Television test card transmitted from GB3TV.

that of the satellites, although the same pre-emphasis standard (CCIR Recommendation 405-1) is used. While the video transmission is one way only, use of the 144.75MHz talkback frequency permits full duplex audio.

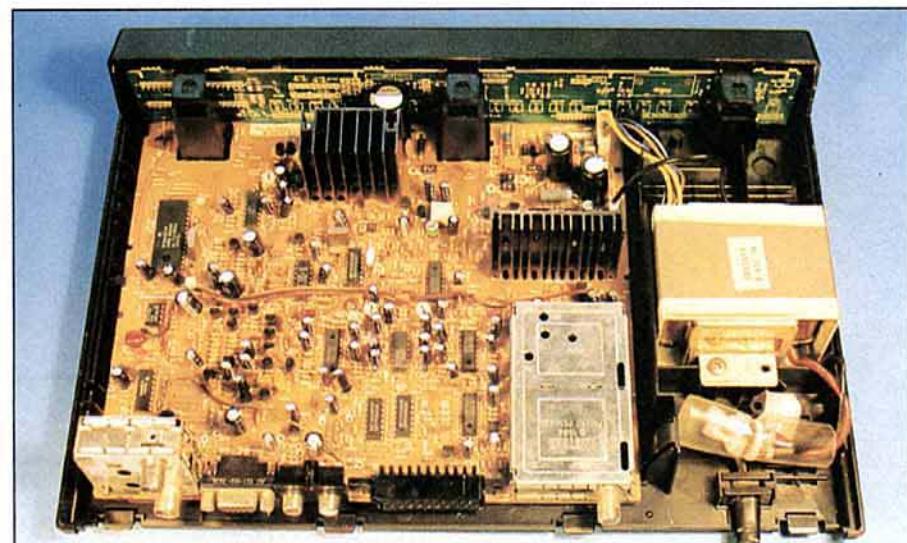
Video sources for transmission include the family camcorder and various personal computers such as the Spectrum and BBC B.

Only a few years ago colour video cameras were quite expensive but 'Camcorders without the recorder' complete with an auto-zoom lens, could be bought for £50 or £60 at various rallies this year. CCD ones are best. Before buying check that all the necessary leads are included as otherwise they may cost more than the camera! The supply voltage may not be a nominal 12V so a simple adapter based on an IC regulator, and incorporating the 'Idiot' safety diode, will be needed.

USING A 'SURPLUS' SATELLITE TUNER FOR 23CM

TO MAKE A START you will need a receiver. When I first started in TV most receivers used on these bands were home-built. The technique was to down-convert to a frequency in the UHF TV band in order to use a standard UHF broadcast band tuner, followed by a home-built unit comprising an IF amplifier, FM discriminator and video amplifier. A board for this system is still available from the BATC.

Nowadays it is all so much easier. All you need is a surplus 'Satellite' TV tuner (SATV) or indoor unit. The availability of these cheap indoor SATV tuners has proved a boon to ATV. There are some manually tuned versions to be found on the surplus market that go for £50 or less as ex rental returns. These units tune between 950 and 1650MHz and



Example of an SATV tunable receiver.



Commercial in-line coax amplifier for 23cm.

are used as a tuneable IF to the LNB (Low Noise Block) which is located at the focus of the satellite TV antenna dish.

The RF stages and tuning of the TV tuner can be used with very little modification but they are not very sensitive. The reason for this is that the noise figure for the receiver as a whole is determined at the LNB. The RF amplifiers, mixer and post mixing amplifiers have an effective gain of 50dB so the gain requirements at the indoor unit are not very high.

This lack of sensitivity of our receiver system means that a preamplifier will be required for all but very local transmissions. I use a low-noise preamplifier at the antenna and a commercial Satellite in-line amplifier both fed with power via a 75Ω coax.

The LA-20 in-line amplifiers, obtainable from most satellite installers, are quite cheap and may be all you need for the local repeater. These amplifiers receive the DC voltage to operate them via the coax cable. An antenna that presents a DC short on the coax (such as an antenna element using a folded dipole or a balun) will require a DC isolating capacitor at the antenna.

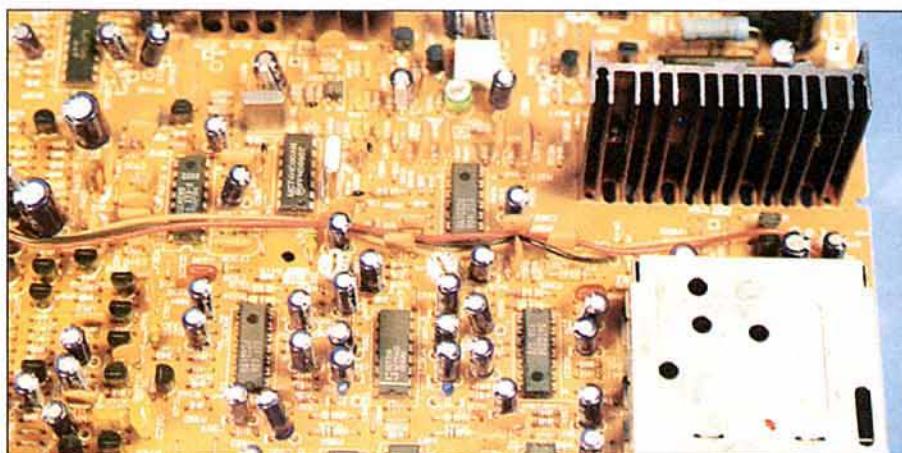
MODIFYING THE AMSTRAD SRX TUNER

AMATEUR TELEVISION uses a lower deviation so the video output of our unmodified SATV receiver will be inadequate. You can sometimes get away with just turning up the internal video gain preset. If this is insufficient a video amplifier can be added.

The early Amstrad tuners such as the SRX 100 or SRX 200 are easy to modify. These tuners have provision for only 16 channels and need an external decoder for encrypted STV so many have now been replaced and can be had for £20 or so at rallies. These provide a direct digital indication of the 23cm reception frequency by pressing the RECALL button or when using the TUNING buttons to set the channel frequency. Unfortunately none of the six sound channels is for 6MHz so it is necessary to replace X302 with an HC18 Xtal of 16.700MHz, available from Quartzlab.

The filter for the sound channels is centred at about 7MHz and it can be moved to 6MHz by increasing C301 and C304 to 22pF and C303 to 390pF for a small improvement in sound channel sensitivity.

To increase the video gain with these units all that is needed is to replace R702 with a 10k resistor, R704 with a 1k2 resistor, R706 with a link and VR701 with a 1k preset (Fig 1). To access the circuit board, remove the three screws underneath the front of the case. Slide off the top, then unclip the front panel. Unplug the power connector and the black ground wire. There is one screw in the centre of the board to remove before it can be unclipped.



General view of the Amstrad SATV tuner board.

THE ANTENNA

YOU WILL NEED an antenna for your modified SATV receiver. I have used a variety of antennas for 23cm including helicals, corner reflectors, yagis, quadloops and currently six-element broadside arrays. As I am not line-of-sight to Dunstable the path loss is about 150dB. Despite this, P4 to 5 signals are obtained with the little 10dB broadside array secured under the eaves.

You will also have to use a very low-loss coax. The SATV receiver uses an F coax connector so there is no problem connecting the SATV receiver to the antenna using this low loss cable (F connectors are made especially for this low loss coax, which has a foil screen, unlike the fish net outer of the typical UHF cable).

A corner reflector design is reproduced in Fig 2 from the RSGB Radio Communication Handbook. This antenna gives a gain of about 13dB and uses a simple dipole radiator at the focus of the reflector. The advantage of this dipole feed is that its impedance is 75Ω , which gives a good match to CATV coax. Additionally the dipole does not present a DC short on the coax.

I use two antennas; one for receive on 1318MHz and the other for transmitting 15 watts on 1249MHz.

A three-pole filter, tuned to 1318MHz, is used before the receive preamp so that I can see the images I am transmitting (look-through).

Those with line of sight paths get away with

less than 1 watt! A point of interest is that due to ground and other reflections it is useful to vary the height of the antenna over a small range to obtain optimum results.

For DXing a super masthead preamp can be had from Camtech Electronics but the price will make the rest of the system look cheap!

USING THE TUNER

WHEN YOU HAVE completed the modifications and reassembled the unit do not replace the lid yet. Set VR701 to the halfway point. Connect the unit to a TV via the RF output, switch on the TEST SIGNAL and tune it in on the TV, switch off the test signal. Connect your antenna, select channel 1, use the UP-DOWN buttons to tune to about 1318MHz.

Provided the antenna is aimed at the local

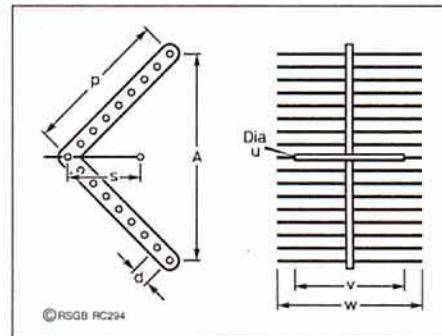


Fig 2: Corner reflector antenna for 23 cm.

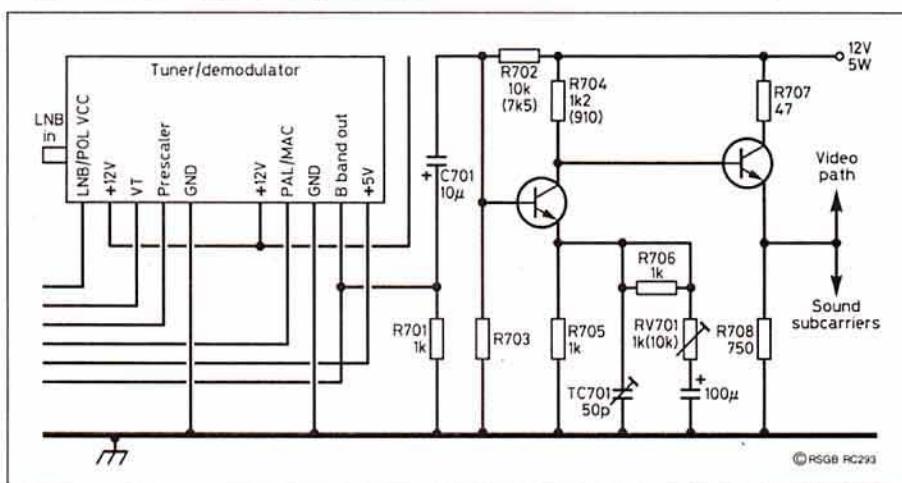


Fig 1: Part of the Amstrad SRX tuner circuit showing changed component values.



Television picture received from G8XTW.

repeater an image should appear, and the AFC will pull the receiver on to the repeater frequency. Try adjusting steps up and down for the best reception then press the preset twice to store the frequency. If you have an oscilloscope connect it to pin 19 of the SCART socket and adjust VR701 for a 2V peak to peak signal on no load, this will then give the standard 1V pp when fed into a 75Ω load. Otherwise adjust for best picture quality if

using the UHF RF connection to a TV's antenna socket. If you have fitted the 16.7MHz xtal, 6MHz sound will be on audio channel 5. Select this by pressing the AUDIO button then store it by pressing preset twice.

TRANSMITTERS

VARIOUS KITS are available for constructing 23cm ATV transmitters and some suppliers are listed below. The cheapest is the old

faithful 'Worthing' kit at £80 available from G8XEU, QTHR. This will give 1.5W but is not for Novice constructors. Tim Forrester, G4WIM, can supply a board for his latest offering, a synthesised 23cm ATV Tx. The board is £15 and the rest of the components can be purchased from Mainline Electronics. This uses mostly surface mount components so a small soldering iron and a steady hand are required. The latest BATC Tx kit is also obtainable from Mainline.

Other suppliers include:

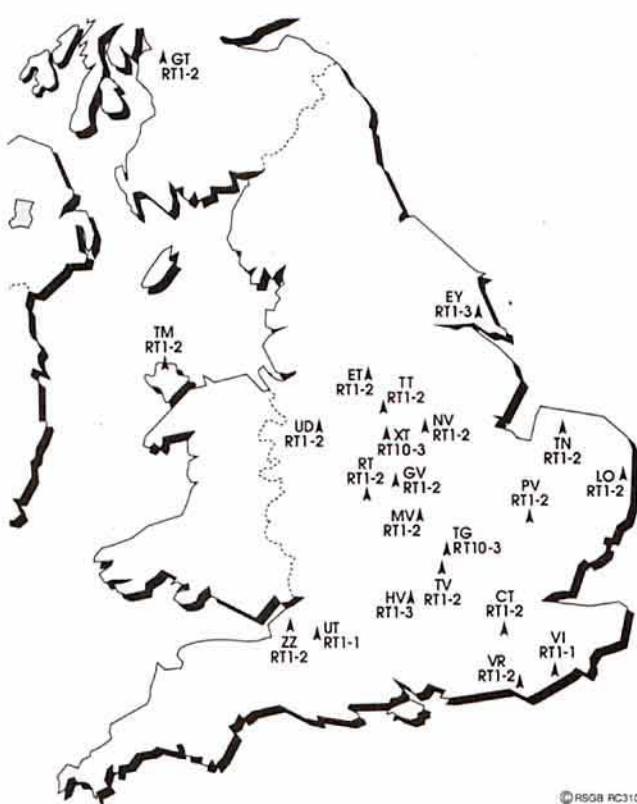
- The British Amateur Television Club. Please contact Dave Lawton, G0ANO. 'Grenehurst', Pinewood Road, High Wycombe, Bucks HP12 4DD.
- Severnside TV Group, 15 Witney Close, Saltford, Bristol BS18 3DX.
- Antennas & Filters – Worthing & District Video Repeater Group.
- Transmitters, software for Spectrum and BBC B, plus various video kits – R Stevens, G8XEU, 21 St James Avenue, Lancing, West Sussex BN15 0NN.

FURTHER READING

An Introduction to Amateur TV, price £4.25.

NEXT MONTH

IN PART TWO, Dave McQue, G4NJU, shows how easy it is to run amateur television on the 10GHz band.



Appendix 1: The television repeater network in the UK.

Television Repeaters

Callsign	Channel	CTCSS	Location	Keeper
GB3UT	RT1-1	J	Bath	G8DKC
GB3ET	RT1-2	D	Huddersfield	G8HUA
GB3GV	RT1-2	C	Markfield, Leics.	G8OPB
GB3LO	RT1-2	F	Lowestoft	G4TAD
GB3MV	RT1-2	B	Northampton	G4WIM
GB3NV	RT1-2	B	Nottingham	G7EJG
GB3PV	RT1-2	C	Cambridge	G4NBS
GB3RT	RT1-2	A	Coventry	G6IQM
GB3TM	RT1-2	H	Amlwch	GW8PBX
GB3TN	RT1-2	F	Fakenham	G4VVU
GB3TT	RT1-2	B	Chesterfield	G1IOR
GB3TV	RT1-2	C	Dunstable	G4ENB
GB3UD	RT1-2	G	Stoke on Trent	G0KBI
GB3VR	RT1-2	E	Brighton	G8KOE
GB3WV	RT1-2	B	Weymouth	G4NTS
GB3ZZ	RT1-2	J	Bristol	G8VPG
GB3EY	RT1-3	B	Hull	G8EQZ
GB3HV	RT1-3	D	High Wycombe	G8LES
GB3TG	RT10-3	C	Bletchley	G4NJU
GB3XT	RT10-3	G	Burton on Trent	G8OZP

ATV Channels

Channel	Input (MHz)	Output (MHz)	Use
RT1-1	1.2765	1.3115	AM TV
RT1-2	1.2490	1.3160	FM TV
RT1-3	1.2480	1.3080	FM TV
RT10-1	10.200	10.040	FM TV
RT10-2	10.225	10.065	FM TV
RT10-3	10.278	10.150	FM TV

Getting Started on Microwave ATV

Concluding the two part article by Dave McQue, G4NJU

CURIOSLY, THE easiest band to get going with a transmitter is 3cm. There are many Gunn diode units (originally used in burglar alarms as movement detectors) on the surplus market. Those without an Rx diode are best although the Rx diode can be used to indicate that the Tx is working. These units were designed for 10.687GHz use but can be retuned down to 10.3GHz and sometimes lower.

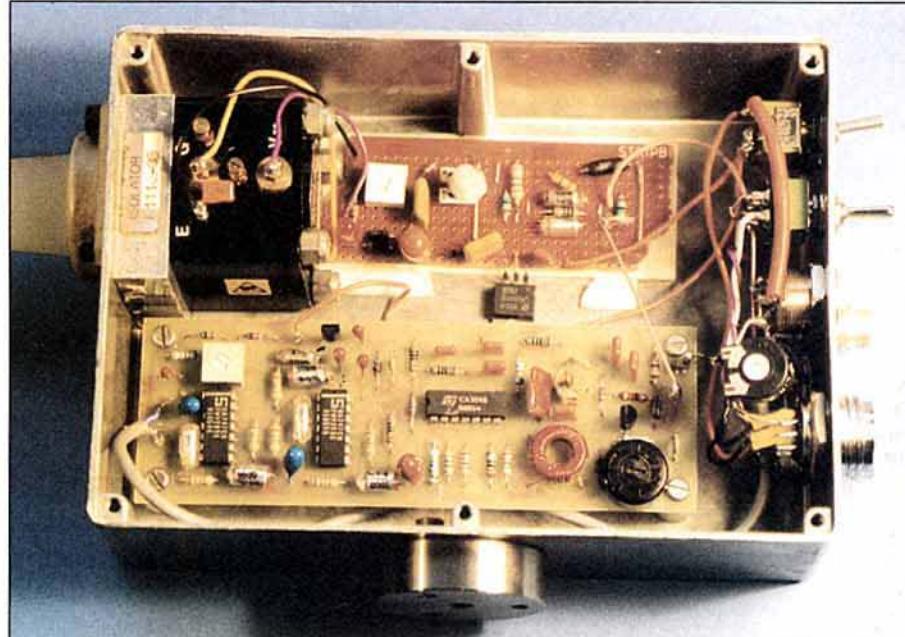
With the Solfan unit this is done by slackening the nut on the tuning screw, setting the screw with only one thread showing and then gently retightening. The power output is only about 10 milliwatts, but as antenna gains of 20dB from simple horns and over 30dB from moderate sized dishes are normal this is adequate for line of sight paths. The important thing to remember is *not* to look into the waveguide where, due to the small aperture, the local field strength is more than 10mW per square centimetre. Of course with a horn attached the aperture is increased and the field density reduced. The cast horn that comes with these units has a gain of about 10dBi and will give results over a kilometre or so. For groups of ATVers in line of sight this is the band to use. There are a few 10GHz repeaters and some of the 1.3GHz repeaters are proposing 10GHz inputs.

GUNN DIODE MODULATOR

THE CIRCUIT OF a suitable video modulator for a Gunn diode transmitter is shown in Fig 4 and can be built on Veroboard. The Gunn diode requires a supply of about 7 to 8 volts at about 120mA. Apply more than 5V of the correct polarity to ensure the survival of the diode.

Varying the voltage varies the output frequency. Given that the input signal from the camera is 1 volt p-p into 75Ω and less than this is required for 3.5MHz deviation a compound emitter follower is used. The BF259 output transistor is one normally found in the output stages of colour TVs driving the cathodes of the CRT and I obtained some from scrap TV sets.

The input network provides the standard pre-emphasis. The $10\mu\text{H}$ choke and sound trap coil are available from Maplin as WH35Q and UL55K respectively. The video from a typical colour video camera is limited to a bandwidth of 5MHz or less but the digital output of the home computer will require a 5MHz low pass filter. A board for this is available from the BATC and this can be fitted inside the case of a Sinclair Spectrum.



10GHz Transmitter and modulator.

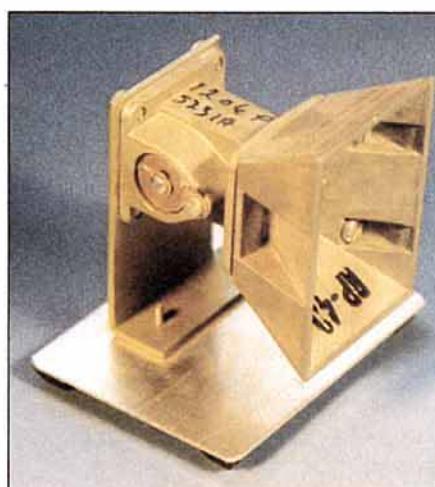
RECEIVER FOR 10GHZ

FOR RECEIVING 10GHz I now use modified satellite LNBs. The earlier 'Skyscan' and 'Echostar' have proved the most straightforward to convert. Pristine versions cost about £30 with secondhand ones somewhat cheaper. Ensure that they have not suffered water damage due to leakage before parting with cash. The modifications involve removing the 10GHz local oscillator dielectric reso-

nator puck and replacing it with one that will tune the oscillator to 9GHz, I use a nominal 8.2GHz oscillator obtained from Oakbury Components.

The oscillator drain line has to be extended so it will work at 9GHz. Two other lines need to be extended in the amplifier section, (see photo opposite). The performance is such that GB3TG at 4 km distance on 10.15GHz is received just on open waveguide, although a small horn is used to avoid desensitizing when transmitting on 10.25GHz and to enable 'look-through'. When so retuned and connected to the Amstrad the frequency indicated, if you assume a nought inserted after the lefthand one, is that in the 10GHz band.

If you have a suitable sound LNB I can retune it for you for £20 including the resonator.



10GHz Gunn diode assembly transmitter.

CONCLUSION

HERE I HAVE ATTEMPTED to give you a glimpse of what is possible and show that ATV is no longer the preserve of the well heeled or highly skilled. However, those of you wishing to take a more than casual interest in ATV will be well advised to join the British Amateur TV Club (BATC) which is the specialist body affiliated to the RSGB. CQ-TV is sent to BATC members quarterly and many specialist components and publications are available to members. The annual subscrip-

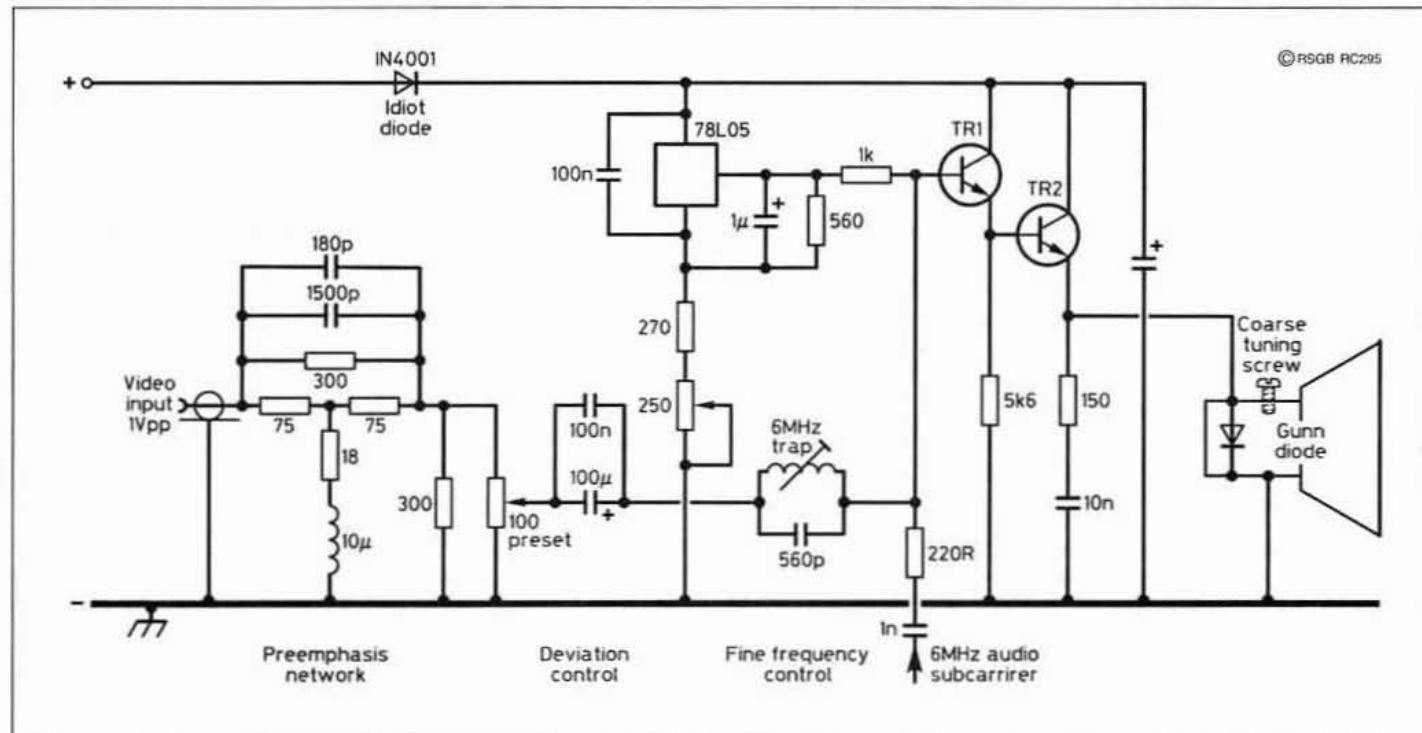
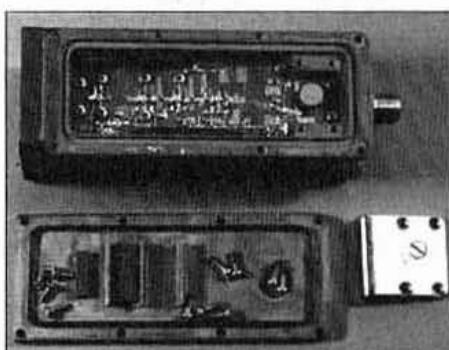


Fig 4: 10GHz Gunn diode modulator.

tion is £9. You can obtain an application form from The Subscriptions Dept, Greenhurst, Pinewood Road, High Wycombe, Bucks, HP12 3BR.

TV EQUIPMENT SUPPLIERS

- FOR UHF COMPONENTS, microwave transmitter and receiver kits (send for a catalogue): Mainline Electronics, Manor Court, The Ford (off Little Glen Road), Glen Parva, Leicester LE2 9TL. Tel: 0533 780891.
- The British Amateur Television Club. Please contact Dave Lawton, G0ANO. 'Greenhurst', Pinewood Road, High Wycombe, Bucks HP12 4DD.
- Worthing and District Video Repeater Group. Please contact R Stevens, G8XEU, 21 St James Avenue, Lancing, West Sussex BN15 0NN.
- QuartSLab Marketing Ltd, PO Box 19, Erith, Kent DA8 1LH (for crystals).
- Camtech Electronics, 21 Goldings Close, Haverhill, Suffolk CB9 0EQ. (for very low noise preamplifiers).
- Severnside TV Group, 15 Whitney Close, Saltford, Bristol.
- Oakbury Components, Oakbury House, Mill Lane, Berks. Tel: 0488 71458



LNB with modified tuning for 10GHz.

Available from the RSGB

The ATV Compendium

by Mike Wooding, G6IQM

Members' Price: £4.89

Slow Scan TV Explained

by Mike Wooding, G6IQM

Members' Price: £5.44



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